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Where Does the Time Go? An Investigation of Self-Reported Time Allocation

by

Cory Stanton

Thesis

Submitted to the Department of Psychology

Eastern Michigan University

in partial fulfillment of the requirements

for the degree of

MASTER OF SCIENCE

in

Clinical Behavioral Psychology

Thesis Committee:

Thomas Waltz, Ph.D., Chair

Flora Hoodin, Ph.D.

James Todd, Ph.D.

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Ypsilanti, MI

Dedication

This thesis is dedicated to my family, who taught me the value of hard work and continue to love and support me.

Acknowledgments

I would like to extend sincere gratitude to my master's advisor, Dr. Thomas Waltz. Since the first day of class, his intellectual curiosity, his work ethic, and his commitment to theoretical rigor have been strong influences on my professional development. Without his guidance, patience, and inspiration, this thesis project would not have been possible. I would also like to thank the members of my committee, Drs. Flora Hoodin and James Todd, for their advice, critiques, and support. Their participation on my committee has enhanced the strength of this project. I thank Drs. Tamara Loverich and Claudia Drossel for their mentorship, as well as their encouragement in my professional endeavors. Special thanks goes to Drs. Tony Papa and William Follette at the University of Nevada-Reno, for statistical and methodological discussions. I would also like to acknowledge the Clinical Behavior Analysis Lab at EMU, for their encouragement and friendship. Finally, I would like to thank my master's cohort. Having a group of engaged, hard-working, and intelligent scholars as friends has deeply enriched my experience in the Clinical Behavioral Psychology program. Team Cohort, it has been a privilege to grow as an individual alongside you all. Thank you for everything.

Abstract

Depression is recognized as a substantial contributor to the global burden of disease, as well as economic productivity. Behavioral activation has been shown to be an efficacious treatment for depression, drawing on the work of early behavioral theorists and research on the quantitative matching law. Recently, scholars have called for increased theoretical rigor in conceptualizing psychological health, as well as increased conceptual and methodological dialogue between basic and applied researchers. The present study examined the validity of a novel self-report measure of time allocation, an extension of the matching law. A cross-sectional sample of 204 undergraduate psychology students completed measures of behavioral and emotional health in addition to the time allocation task. The task asked participants to report their time spent engaging in meaningful activities, managing life's negatives, and sleeping. It also asked participants to subjectively rate their experience of these life areas on a 1–10 scale. Pearson correlations, multiple regression analyses, and one-way ANOVA were used to evaluate the convergent, discriminant, and predictive validity of the time allocation task. Approximately half of the expected Pearson correlations were significant. Questions related to the quality or effectiveness of allocated time had stronger relationships with conventional and behavioral measures of depression than the time questions, a finding that was not expected. Average time spent managing life's negatives, as well as the subjective quality ratings of all three areas of time, were significant in differentiating depression severity groups. The overall time allocation task demonstrated some predictive validity, but did not show incremental validity when other constructs were controlled for. Strengths and weaknesses of the project, as well as implications for clinical behavioral process research, are discussed in the conclusion.

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Where Does the Time Go? An Investigation of Self-Reported Time Allocation

Major depressive disorder (depression) is a significant economic burden and contributor to the global burden of disease (Moussavi, Chatterji, Somnath, Emese, Tandon, Patel, & Uston, 2007; Kessler et al., 2003; Stewart, Ricci, Chee, Hahn, & Morganstein, 2003). Division 12 of the American Psychological Association has designated 13 treatments as having research support; of these, cognitive therapy (CT) and behavioral activation (BA) are the most commonly used therapies designated as having strong research support. Behavioral activation has been identified as an evidence-based therapy, comparable to cognitive therapy in terms of efficacy (Sturmey, 2009; Kanter et al., 2010). A key dismantling study has shown that behavioral activation may be the active component of cognitive therapy (Jacobson et al., 1996). Recently, modern behavioral treatments are also demonstrating empirical evidence in the treatment of depression and other mood disorders, such as acceptance and commitment therapy (ACT) (Hayes, Strosahl, & Wilson, 2011), mindfulness-based cognitive therapy for depression (MBCT) (Segal, Williams, & Teasdale, 2012) and others. Despite the development and dissemination of effective treatments, depression remains undertreated in the general population, especially in primary care settings (Cassano & Fava, 2002). Behavioral activation has been recognized as a portable, efficacious, and cost-effective treatment for depression, capable of being delivered by a non-specialist (Ekers et al., 2011), a computer (Spates et al., 2013), and a smartphone (Hoa Ly et al., 2014). The framework of values and values-congruent action has become a common ingredient in several recently developed behavior therapies, such as ACT, as well as values-based behavioral activation (Hayes et al., 2011; Lejuez, Hopko, Acierno, & Pagoto, 2011).

According to Wilson, Hayes, Greg, and Zettle (2001), “values are verbally constructed, globally-desired life directions: Values manifest themselves over time and unfold as an ongoing

process rather than an outcome" (p. 235). Values, and other kinds of verbal statements or rules about one or more person's behavior, have been studied in the social psychology and cultural anthropology literatures (Kunkel, 1997; Harris, 1977). From a behavior analytic perspective, values function as formative and motivative augmentals; formative augmentals are verbal behavior that establish new consequences for behavior, while motivative augmentals alter the strength of an existing consequence (Hayes, Strosahl, & Wilson, 2011). One important conceptual component of values is that they specify behavior patterns that are naturally reinforcing and sustain themselves over time; these behaviors should be maintained by positive reinforcement as opposed to negative reinforcement. Activities and demands that chiefly serve to escape or avoid aversive consequences would not be considered "valued living." In sum, if values are important to functioning, then those individuals who spend more time on things they value should in theory function more effectively than their peers who do not. When considering how to characterize patterns of behavior over time and determine whether these patterns align with values, the experimental analysis of behavior may offer interesting conceptual tools with which to characterize such patterns. It is necessary to review the behavior analytic theory of depression before considering how conceptual tools from "lab bench science" may be relevant to modern behavior therapies.

The Behavior Analytic Conceptualization of Depression

The first conceptualizations of depression from a behavioral perspective grew out of the work by Ferster (1973) and Lewinsohn (1974). Ferster suggested that depressed individuals are passive, whose behavior is derived from aversive prompts and commands from other people, rather than emitted without the proximal influence of a prompt. Ferster also speculated that, as opposed to two individuals engaging in a back and forth conversation, individuals with

depression tend towards a passive listening style in which they are reinforced by having someone talk to them, and they reinforce the speaker by listening (1973). He emphasized that a behavioral account of depression needs to focus on frequency of responding, as opposed to topography:

> Although a description of a depressed person's repertoire stresses activities he does not engage in, these absent performances are usually parts of his present or potential repertoire, but they occur with a low frequency…Most persons, at one time or another, while looking quietly out of a window, say "that was a dumb thing for me to do." They can at times, be sad, unhappy, or dejected, or lose interest in an activity. In any one of these instances it may not be possible to distinguish them from a pathologically depressed person. (p. 861)

The work of Lewinsohn and colleagues in examining depression closely parallels the work of Ferster. In order to examine the relationship between mood and pleasant activities, as well as to answer whether mood or activity acted as an antecedent for change in the other, Lewinsohn & Libet (1972) conducted an experiment in which 30 individuals were evenly sorted into depressed, non-depressed psychiatric controls and normal controls. They found a strong relationship between mood and engagement in pleasant activities, a finding that was successfully replicated in a follow-up study with an expanded sample (Lewinsohn & Graf, 1973).

According to Martell, Dimidjian & Herman-Dunn (2010), behavioral activation can be described as:

> A brief structured treatment for depression that aims to activate clients in specific ways that will increase rewarding experiences in their lives…BA also focuses on processes that

> inhibit activation, such as escape and avoidance behaviors. BA is based on the premise that problems in vulnerable individual's lives reduce their ability to experience positive reward from their environments, leading to the symptoms and behaviors that we classify as depression. (p. 21)

Recent treatment manuals for BA have emphasized the role of values in selecting activities (Lejuez et al., 2011; Martell et al., 2010). This application of values is in line with Ferster's (1967) argument in favor of naturalistic, positive reinforcement over aversive control and arbitrary reinforcement in treating human behavior problems.

The Matching Law

The matching law is a major contribution of the experimental analysis of behavior and has influenced the development of behavioral activation (Lejuez et al., 2011). Waltz & Follette (2009) defined matching as "the mathematical relation between the time spent engaging in a type of activity and the rate of reinforcement for that type of activity" (p.52). The matching law was derived from Herrnstein's (1961, 1970) research examining pigeon performance on concurrent, multiple, and single schedules. He is generally credited with originally conceptualizing the matching law as a continuation of Skinner and Thorndike's law of effect. The matching law's basic form is defined as $\frac{R_T}{R_T+R_e} = \frac{r_T}{r_T+ r_e}$, in which the rate of responding of the target behavior (R_T) relative to the rate of all behaviors the organism engages in (R_T +R_e), and is directly proportional to the rate of reinforcement that occurs for that target behavior (r_T), relative to the rates of reinforcement that occur for all of the organism's behavior ($r_T + r_e$). The matching law has been shown to characterize many kinds of behavior, such as two and three point shots made by college basketball players (Vollmer & Bourret, 2000), severe problem

behaviors of individuals with developmental disabilities (Borrero & Vollmer, 2002), the verbal behavior of college students participating in a discussion about a topical issue (Borrero et al., 2007), and the verbal behavior of adolescent boys in peer dyads (McDowell & Caron, 2010). The matching law has undergone many revisions since its original inception (McDowell, 2012).

McDowell (1982) outlines the clinical utility of the matching law equation. His account relies on the hyperbolic form of the matching equation, given as $R = \frac{kr}{r+r_e}$ where *k* and r_e are parameters; *k* is a free parameter that represents the maximum obtainable response rate for a given response form and a given reinforcer, and it is equivalent to the denominator of the left side of the traditional matching equation. In a response-based matching analysis, *k* is the overall rates of all responding, considering all response classes, and in a time based matching analysis, *k* is the total time allocated to all responses. The variable r_e is representative of how stimulating the environment is, with a low r_e representing a "barren" environment and a high r_e representing an environment "rich" in alternative sources of reinforcement. McDowell (1982) argued that the hyperbolic form represents a more nuanced representation of Skinner's original law of effect by describing how the relationship between response rate and reinforcement is hyperbolic and by "asserting that response rate is also governed by the rate of reinforcement supplied to the organism from all other concurrent sources" (p. 5).

Application of the matching law requires knowing the rate of responding for the behavior of interest, relative to all the behaviors the organism engages in (within the relevant analytical context). Another way of conceptualizing matching is to consider time allocation, as opposed to response allocation.

Early research into how organisms' choices might be considered from a time allocation perspective was conducted by Baum and Rachlin (1969). When six pigeons were placed on multiple VI schedules of food reinforcement, they found that "within the limits of individual variation…we can conclude that the ratio of times is directly proportional to the ratio of reinforcements" (Baum & Rachlin, 1969, p. 866). Furthermore, in a computer game based experiment by Baum (1975), evidence showed that choice can be measured by how an organism distributes its time between available alternatives. Three human participants were instructed to defend their "ship" against incoming missiles, red or green. Participants had two telegraph keys and two push buttons. The telegraph keys detected the missiles by deploying a sensor (turning on a red or green lamp), and the corresponding push-buttons "destroyed" them. When a sensor was turned on, the ships shields were "down" and a missile could damage the ship (this represented response cost, so that using a sensor was always a choice to not use the other). In addition, a change over delay (COD) of 2 seconds further penalized switching keys, during which no signal appeared on the screen. The experiment was designed such that, as participants were virtually holding one key or the other for the duration of the experimental session, response allocation was essentially the same as time allocation. All three participants received the same instructions and no other supplemental hints or guidance. Interestingly, two participants were able to describe the various contingencies operating during the experiment, while the third could not, in a debriefing after the first set of trials. In addition, although one participant (Doug) was able to verbally articulate the contingencies of the experiment, his responding did not fit the matching paradigm until the changeover delay (COD) was lengthened. Thus, with an adequate COD in place, time allocation matching was demonstrated in two out of three participants.

Research in the matching law paradigm has focused largely on responding to concurrent variable-interval schedules of reinforcement. As the present study sought to understand how participants might self-report behavior across several broad areas, it is pertinent to examine how other researchers have conceptualized and analyzed data for more than two schedules of reinforcement. Pliskoff and Brown (1976) conducted an experiment to examine the effects of three concurrent-VI schedules on the responding of three individual White Carneaux pigeons who were at 80% feeding weight. The operant chamber contained two keys for the pigeons to peck; one was illuminated by yellow, green, or red light, and the other was white and served as the changeover key in a Findley switching procedure (a peck at this key cycled the other key to another schedule). A peck at the changeover key had a 66% chance of changing the schedule, with the other two schedules having an equal probability of becoming active. A change over delay of 1.5 seconds was in effect following every peck on the changeover key, regardless of whether schedule actually changed. Nine experimental conditions were derived from arranging the following intervals (min) in groups of three: 1.33, 1.5, 1.88, 2.4, 4, 6.67, 12, 15, and ∞ (extinction). During each session, total reinforcement was restricted to 45 times per hour. Daily experimental sessions ended after 60 deliveries of reinforcement, and conditions were changed once a 10-day period of stable responding elapsed.

In their analysis, Pliskoff and Brown plotted both relative response rate and relative time against relative reinforcement rate in separate graphs. Relative time was calculated by dividing the amount of time spent on each schedule by the total responding time. The authors also analyzed whether relative response rate or relative time more closely approximated relative reinforcement rate. As a result of examining performance on three schedules, Pliskoff and Brown

(1976) concluded that "it [was] clear from the data presented that matching occurs in much the same fashion as with two schedules" (p. 73).

Myerson & Hale (1984) argued that behavioral issues in applied settings can be conceptualized as choice problems and discussed three ways our understanding of the matching law differs in an experimental setting as compared to applied settings. These included "…(a) topographic differences between inappropriate and competing responses; (b) qualitatively different reinforcers for inappropriate and competing responses; and (c) reinforcement schedules for inappropriate and competing responses that differ from the probabilistic schedules considered above" (Myerson & Hale, 1984, p. 9). An application of the matching law in a clinical setting should consider these differences.

McDowell (1982) discusses intervention strategies informed by a matching law paradigm. For reducing a problem behavior, besides extinction and punishment, Herrnstein's (1970) equation suggests that increasing the rate of reinforcement for a response alternative as well as increasing the rate of free or noncontingent reinforcement would be suitable interventions (McDowell, 1982). When the goal is to increase the frequency of a desired behavior, this hyperbola suggests that one could decrease the rate of reinforcement for a concurrently available response or decrease the rate of noncontingent reinforcement (McDowell, 1982).

Time allocation to specified categories of tasks has been previously employed by Sarah Hayes and colleagues (2010) to examine possible mechanisms of action in acceptance-based behavior therapy (ABBT). Over the course of a wait list control trial (Roemer et al., 2008) and an open trial (Roemer & Orsillo, 2007), 43 participants who met criteria for Generalized Anxiety Disorder (GAD) or major depressive disorder plus GAD, completed a weekly assessment that asked participants to report what percentage of their time they spent engaging in some therapy-

relevant tasks from the previous week on a scale of 0 to 100. Some items on this measure include, “What percentage of time did you find yourself worrying over the past week?” and “What percentage of time did you were spending time on the things important to you?” In examining their results, Hayes and colleagues found that clients reported accepting internal experiences and engaging in valued action a little less than 50% at the beginning of ABBT to a little less than 75% at the end of treatment. This increase predicted responder status though, interestingly, change in acceptance predicted quality of life while valued action did not (Hayes et al., 2010). In their conclusion, the authors suggest that “one challenge in studying longitudinal change is the balance between obtaining frequent assessments that are brief enough that they are acceptable to respondents yet reliable and valid enough that they adequately assess the construct of interest” (Hayes et al., 2010, p. 243). Other researchers (Correia, Carey, & Borsari, 2002; Correia, Carey, Simons, & Borsari, 2003) have conducted research on college students’ substance use from a Lewinsohnian perspective, using the Pleasant Events Schedule and other measures in order to estimate how much behavioral processes are related to binge drinking.

In summary, the matching law has served as a powerful tool for conceptualizing choice behavior over time in the experimental analysis of behavior. As modern behavior therapies focus on assisting clients in allocating their behavior across time in productive and values-based ways, novel measures of relevant behavioral processes may assist clinicians in tracking and conceptualizing their client’s behavior. Since gathering accurate rates of responding is a significant practical limitation in outpatient therapy settings, time allocation may be a theoretically acceptable proxy, based on research in basic behavioral science.

The goal of the present study is to evaluate whether self-reported time allocation on the part of human participants is associated with depression symptoms and other measures of

psychological health. Further, this study sought to examine whether there was a relationship between the molar processes of time allocation and monetary discounting in the present sample. The present study investigated the possible convergent, discriminant, and predictive validity of a novel time allocation self-report measure. It also investigated whether the time allocation task was predictive of how severe depression symptoms were on a standardized depression measure, and whether the time allocation task accounted for unique variance in a model designed to predict depression symptoms.

Hypotheses

1. Average time of meaningful activities (Avg_SR+), average time spent managing life's negatives (Avg_SR-), and sleep will show theoretically consistent correlational relationships with standardized measures.

	PHQ-9	BADS	AAQ-2	SF-36	VQ-Pro	VQ-Obs	(ln) k
SR+ Time Allocation	↓	↑	↓	↑	↑	↓	↓
SR- Time Allocation	↑	↓	↑	↓	↓	↑	↑
Sleep	↓	↑	↓	↑	↑	↓	↓

Figure 1. Predicted zero order correlations of Hypothesis 1.

Pearson correlations will be calculated for all study measures. These correlations are suggested as indicators of convergent and discriminant validity. Time allocated to meaningful activities as well as to managing life's negatives are predicted to positively correlate with related self-report measures (demonstrating convergent validity) and to be negatively correlated with measures of opposing constructs (demonstrating divergent validity). Overall, time allocation to meaningful activities is expected to associate with wellness, and time allocated to managing

life's negatives will demonstrate an inverse relationship. It is also expected that time allocated to sleep will correlate with wellness; the extent that participants experience hypersomnia will place a limitation on the ability to examine that relationship.

It is hypothesized that there will be a positive correlation between how much time participants allocate to positively reinforced (meaningful) activities and the activation subscale of the BADS (Behavioral Activation for Depression Scale; Kanter, Mulick, Busch, Berlin & Martell, 2006), the Progress subscale of the VQ (Valuing Questionnaire; Smout, Davies, Burns, & Christie, 2014), the SF-36 (Short Form-36; Ware & Gandek, 1998) and hours of sleep reported; there will also be negative correlations between positive reinforcement and the following: the avoidance/rumination subscale of the BADS, the Obstruction subscale of the VQ, the PHQ-9 (Patient Health Questionnaire-9; Kroenke & Spitzer, 2002), the natural log of the individual discounting parameter, and the AAQ-2 (Acceptance & Action Questionnaire-2; Bond et al., 2011). Regarding the AAQ-2, the initial validation study of the BADS found moderate positive and negative correlations for the avoidance and activation subscales respectively on the original AAQ, and the overall BADS total has previous been moderately correlated (Kanter et al., 2006). As both time allocation and the BADS are based on behavioral processes, a similar relationship is expected. Correlations between time allocation and other measures in the present study are expected for both the "raw" numbers that participants provide as well as the ratio of meaningful activities/managing life's negatives.

It is also hypothesized that reported hours of sleep, averaged across one week, will correlate negatively with the PHQ-9, SF-36, the VQ-Pro, and the AAQ-2. It is hypothesized that the AAQ-2 will correlate positively with avoidant time allocation self-report and the PHQ-9, as higher scores on the AAQ-2 should relate to greater emotional distress (Bond et al., 2011). It is

also hypothesized that the natural logarithm of each participant's discounting parameter will correlate positively with the AAQ-2, avoidance/rumination subscale of the BADS, negative time allocation, PHQ-9, and SF-36; it will negatively correlate with the activation subscale of the BADS. Finally, it is expected that there will be a stronger correlation between emotional health and time allocation than physical health and time allocation due to floor effects related to the age of the population sample.

2. The Time Allocation Task will account for a significant amount of variance in a one-way ANOVA of depression scores as measured by the PHQ-9 when these scores are sorted based on established clinical groupings.

This hypothesis is a test of whether time allocation is differentiated by the level of depression a person reports and thus whether time allocation has discriminant validity in distinguishing between levels of depression.

3. In a multiple regression model, one or more variables that constitute the Time Allocation Task will account for a significant amount of unique variance in predicting depression scores.

This hypothesis is a test of the predictive validity of time allocation. Multiple regression analysis will evaluate both the predictive and incremental predictive validity of the Time Allocation Task on depression scores (both PHQ-9 and BADS).

Methods

Participants

Table 1 characterizes the sample of the present study. Participants were recruited from a psychology departmental subject pool at Eastern Michigan University. Students were offered SONA credits in exchange for their participation. Informed consent and data collection took place on the online survey platform Qualtrics. Participants were asked to complete a brief demographics survey, a set of established psychological measures, and were then asked to download and complete the Time Allocation Task in an Excel spreadsheet before emailing it to the primary author. A total of 389 students completed the Qualtrics survey; however, only 215 filled out the Time Allocation Task and sent it to the primary author. In addition, 11 participants submitted a Time Allocation Task with missing data. These participants' data were omitted from the final data analysis.

The sample used for the present analyses ranged in age from 18 to 56 years old (M = 22.3, SD = 6.64). They were predominantly female (74.5%) and identified as either single (39.7%) or in a relationship (43.1%). Roughly half of the sample grew up in a household in which one of their parents had either attended some college (24%) or had finished a 4-year degree (24.5%).

Table 1

Maximal Completer Sample Characteristics

Variable	Frequency	Percentage
Gender		
Male	48	23.5%
Female	152	74.5%
Transgender—MTF	1	0.5%
Transgender—FTM	1	0.5%
Agender	1	0.5%
Genderfluid	1	0.5%
Age		
18	52	25.5%
19–29	134	65.7%
30–39	11	5.4%
40–49	3	1.4%
50–59	4	2.0%
Parental Education		
Middle school	1	0.5%
Some high school	2	1.0%
High school diploma	32	15.7%
GED	2	1.0%
Some college	49	24.0%
2-year degree	24	11.8%
4-year degree	50	24.5%
Some graduate school	6	2.9%
Master's degree	32	15.7%
Ph.D.	5	2.5%
Specialist Degree	1	0.5%
Hours Worked Weekly		
0	61	29.9%
1–9	13	6.2%
10–19	37	18.1%
20–29	47	23.0%
30–39	18	8.9%
40–49	20	9.2%
50–59	6	2.9%
60	2	1.0%
Relationship Status		
Single	81	39.7%
Casually dating	12	5.9%
In a relationship	88	43.1%
Married	16	7.8%
Divorced	5	2.5%
Separated	0	0.0%
Widowed	0	0.0%

Domestic partnership	2	1.0%

Design

The present study employed a cross-sectional design, examining the correlations between the Time Allocation Task and established measures of depression (PHQ-9, BADS). Relationships between the Time Allocation Task and other established measures of psychosocial variables (SF-36, AAQ-2, VQ) were also examined for signs of convergent and discriminant validity. At a process level, the study examined the correlation between monetary discounting and time allocation as molar functional relations. The present study also examined whether individuals in varying categories of depression symptoms are differentiated on their time allocation.

Assessments and Measures

Time Allocation Task. Respondents were asked to consider three different types of activities: meaningful activities, managing life's negatives, and sleep. Figure 2 depicts the Time Allocation Task. Note that the dates displayed are determined by a formula in Excel that subtracts 1 + *n* days from the present date in order to generate a retrospective of the past 7 days, where *n* ranges from 0 to 6. A second spreadsheet in the Time Allocation Task workbook served as a representative example for participants to examine as needed. Figure 3 depicts this example page.

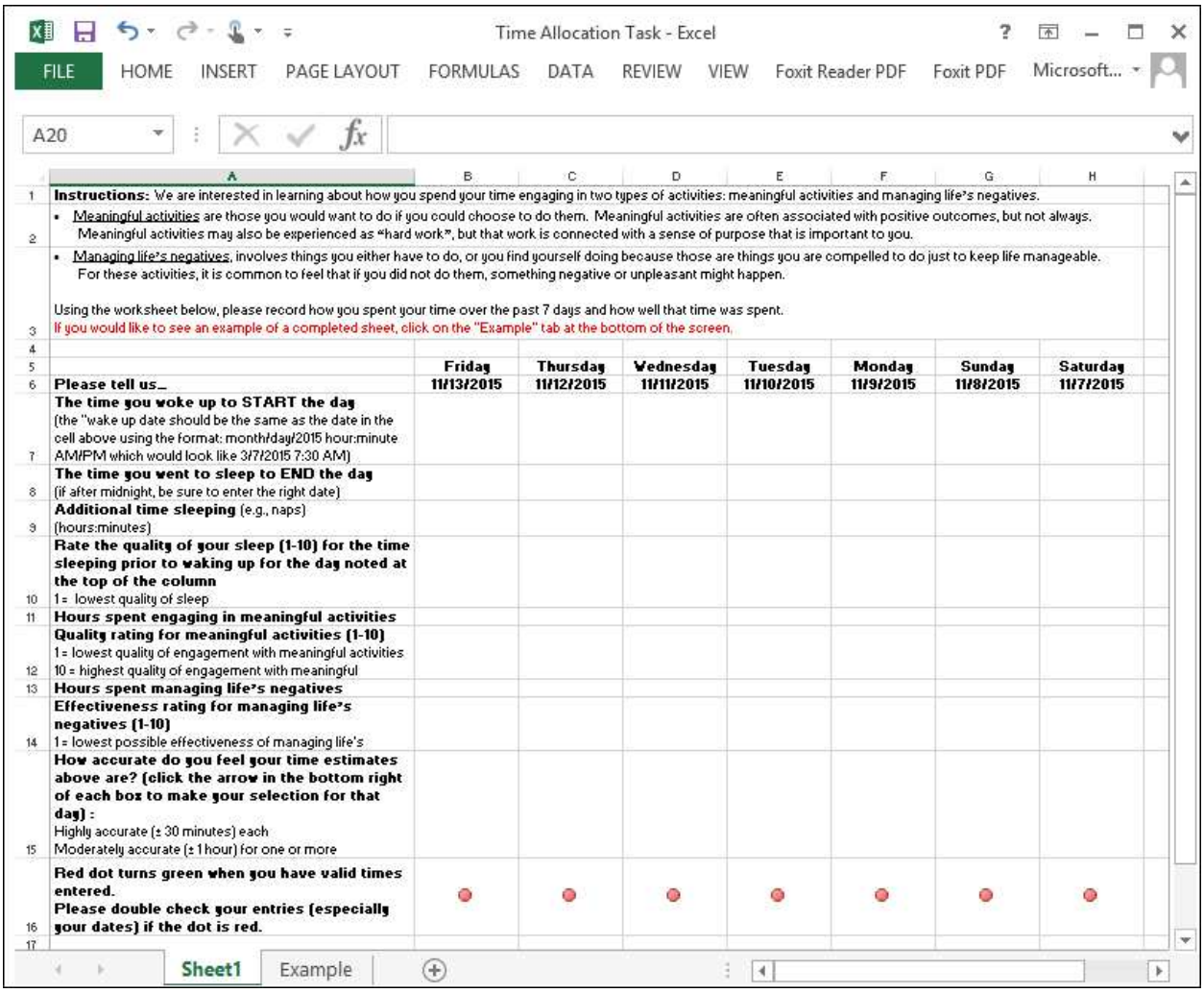
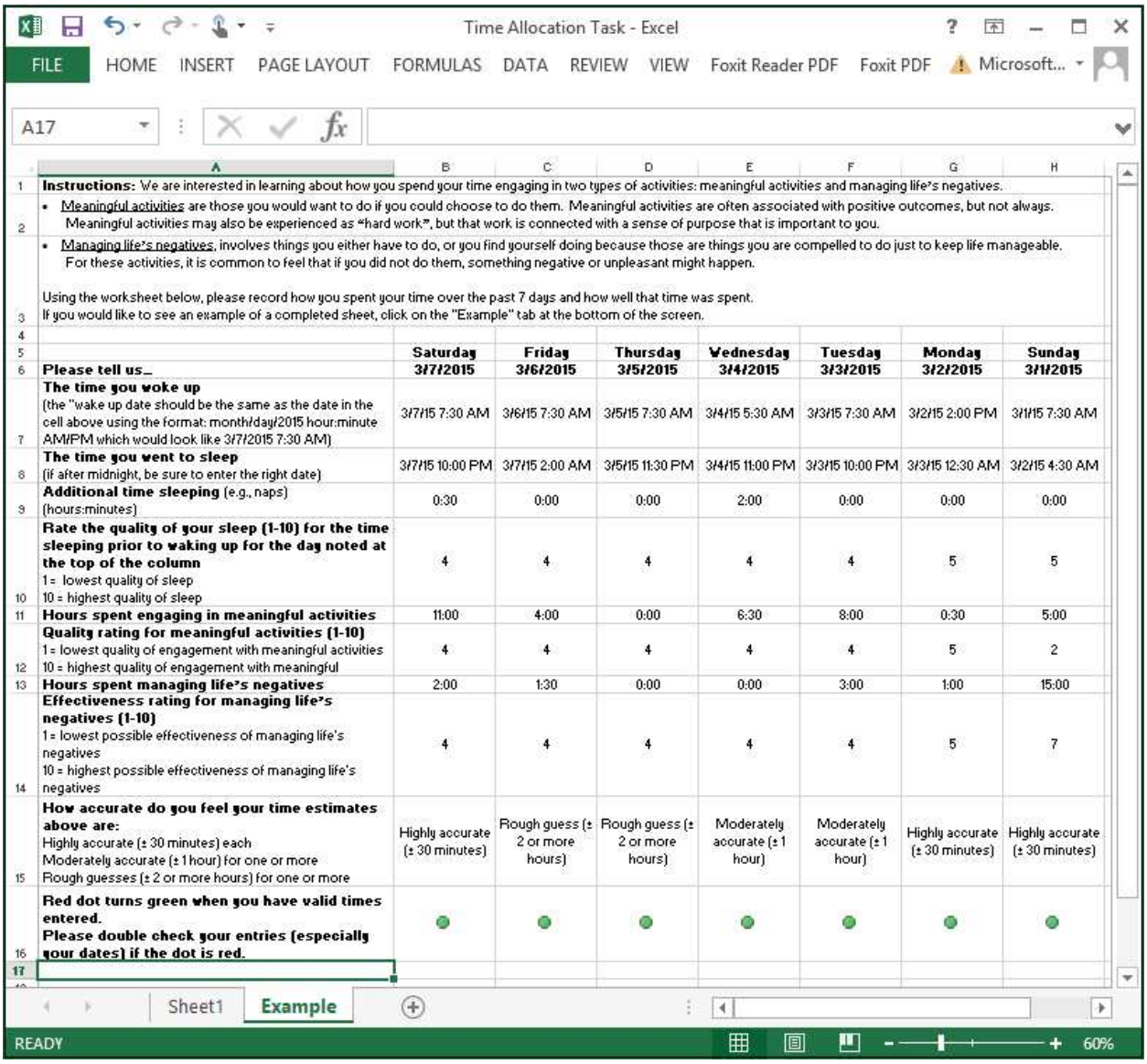


Figure 2. Time Allocation Task—Input page. Participants were instructed to complete each field and return to the author.



	A	B	C	D	E	F	G	H
1	**Instructions:** We are interested in learning about how you spend your time engaging in two types of activities: meaningful activities and managing life's negatives.							
2	• Meaningful activities are those you would want to do if you could choose to do them. Meaningful activities are often associated with positive outcomes, but not always. Meaningful activities may also be experienced as "hard work", but that work is connected with a sense of purpose that is important to you.							
3	• Managing life's negatives, involves things you either have to do, or you find yourself doing because those are things you are compelled to do just to keep life manageable. For these activities, it is common to feel that if you did not do them, something negative or unpleasant might happen. Using the worksheet below, please record how you spent your time over the past 7 days and how well that time was spent. If you would like to see an example of a completed sheet, click on the "Example" tab at the bottom of the screen.							
4								
5		**Saturday**	**Friday**	**Thursday**	**Wednesday**	**Tuesday**	**Monday**	**Sunday**
6	**Please tell us…**	**3/7/2015**	**3/6/2015**	**3/5/2015**	**3/4/2015**	**3/3/2015**	**3/2/2015**	**3/1/2015**
7	**The time you woke up** (the "wake up date should be the same as the date in the cell above using the format: month/day/2015 hour:minute AM/PM which would look like 3/7/2015 7:30 AM)	3/7/15 7:30 AM	3/6/15 7:30 AM	3/5/15 7:30 AM	3/4/15 5:30 AM	3/3/15 7:30 AM	3/2/15 2:00 PM	3/1/15 7:30 AM
8	**The time you went to sleep** (if after midnight, be sure to enter the right date)	3/7/15 10:00 PM	3/7/15 2:00 AM	3/5/15 11:30 PM	3/4/15 11:00 PM	3/3/15 10:00 PM	3/3/15 12:30 AM	3/2/15 4:30 AM
9	**Additional time sleeping** (e.g., naps) (hours:minutes)	0:30	0:00	0:00	2:00	0:00	0:00	0:00
10	**Rate the quality of your sleep (1-10) for the time sleeping prior to waking up for the day noted at the top of the column** 1 = lowest quality of sleep 10 = highest quality of sleep	4	4	4	4	4	5	5
11	**Hours spent engaging in meaningful activities**	11:00	4:00	0:00	6:30	8:00	0:30	5:00
12	**Quality rating for meaningful activities (1-10)** 1 = lowest quality of engagement with meaningful activities 10 = highest quality of engagement with meaningful	4	4	4	4	4	5	2
13	**Hours spent managing life's negatives**	2:00	1:30	0:00	0:00	3:00	1:00	15:00
14	**Effectiveness rating for managing life's negatives (1-10)** 1 = lowest possible effectiveness of managing life's negatives 10 = highest possible effectiveness of managing life's negatives	4	4	4	4	4	5	7
15	**How accurate do you feel your time estimates above are:** Highly accurate (± 30 minutes) each Moderately accurate (± 1 hour) for one or more Rough guesses (± 2 or more hours) for one or more	Highly accurate (± 30 minutes)	Rough guess (± 2 or more hours)	Rough guess (± 2 or more hours)	Moderately accurate (± 1 hour)	Moderately accurate (± 1 hour)	Highly accurate (± 30 minutes)	Highly accurate (± 30 minutes)
16	**Red dot turns green when you have valid times entered.** **Please double check your entries (especially your dates) if the dot is red.**	●	●	●	●	●	●	●
17								

Figure 3. Time Allocation Task—Example page. Provided as a guide to participants.

As shown in Figure 2, the Time Allocation Task asks the responder to provide the following information for each of the previous seven days: 1) wake up time, 2) bedtime, 3) duration of any naps taken, 4) quality of sleep on a 1–10 scale, 5) hours spent on meaningful activities, 6) quality of meaningful activities on a 1–10 scale, 7) hours spent on managing life's negatives, 8) effectiveness of managing life's negatives on a 1–10 scale, and 9) a rating of how accurate the responder feels their recall is for each day. In row 16 of the spreadsheet, colored

dots acted as contextual cues as to whether the participant had entered valid times for each question. If the awake and bed times did not have enough time to encapsulate all of the participant's activities, they remained red until valid times were entered, which then turned the dots green. When consolidating the reported sleep times into an average for data analysis purposes, a six day average was computed and included any naps that participants reported. This was done because the Time Allocation Task could not provide a bed time for a hypothetical day 0, nor a wake time for a hypothetical day 8, due to restricting itself to only 7 days of reporting sleep and wake times.

For analysis purposes, the "Time Allocation" variable is defined as the time estimates and quality ratings themselves. The accuracy ratings are not considered to be conceptually related to the other questions. In addition, this study did not attempt to combine these items into a single composite.

Patient Health Questionnaire-9 (PHQ-9; Kroenke & Spitzer, 2002). The PHQ-9 is a sub module of the PHQ. It is a nine item self-report measure of depression symptoms, based on the *Diagnostic and Statistical Manual of Mental Disorders 4th Edition Text Revision* (DSM-IV-TR). The PHQ-9 is commonly used in primary care and VA hospital settings. It has demonstrated construct validity in a general population sample (Martin, Rief, Klaiberg, & Braehler, 2006). Recent research has found that both sleep duration as well as preference for evening over morning hours (chronotype) contribute to PHQ-9 scores when personality variables are controlled for (Randler, Stadler, Vollmer, & Diaz-Morales, 2012). Higher scores on the PHQ-9 indicate more frequent and severe symptoms of depression. A score of 10 indicates mild depression, a 15 indicates moderate major depression, and a score of 20 or more indicates severe

major depression (Arrol et al., 2010). These divisions were used to sort participants into groups for data analysis in the present study.

Short Form-36 (SF-36; Ware & Gandek, 1998). The SF-36 is a 36-item survey of physical and mental health functioning and provides an overview of general physical and mental status on eight sub-scales. The SF-36 was included in order to capture a general overview of participant well-being. It produces scores on eight sub-scales that consolidate into two main scales, physical well-being and emotional well-being. Each sub-scale ranges between 0 and 100, with higher scores indicating better health. The time allocation measures are hypothesized to have a stronger relationship with the PHQ-9 (depression) measure than the global well-being measure (SF-36), even though the relationship will be in the same direction.

Behavioral Activation for Depression Scale (BADS; Kanter, Mulick, Busch, Berlin & Martell, 2006). The BADS is a 25 item self-report measure designed to measure both avoidance and activation behaviors over the past week. It was developed specifically to assist researchers in studying change processes in BA as well as for use by BA clinicians to measure progress in treatment. The BADS has demonstrated construct validity and a confirmed factor structure, including subscales for activation, avoidance/rumination, work/school impairment, and social impairment (Kanter, Rusch, Busch, & Sedivy, 2008). Higher scores on the BADS indicate greater levels of activation and less frequent avoidance behaviors and impairment.

Acceptance and Action Questionnaire-2 (AAQ-2; Bond et al., 2011). The AAQ-2 is a self-report measure of experiential avoidance and psychological inflexibility. This measure was included in the present study to evaluate negative reinforcement based coping in participants. It is a global measure and is not time bound for the respondent. It asks participants to make a momentary assessment of the applicability of some statements, such as “I’m afraid of my

feelings." Higher scores indicate greater levels of psychological inflexibility and experiential avoidance. The AAQ-2 does not have indicated cutoffs for clinical use, but scores of 24–28 are associated with clinical symptom cutoffs on other measures, such as the Beck Depression Inventory-II (Bond et al., 2011). Both 7- and 10-item versions of the AAQ exist; the 10-item version contains three items that measure engagement in spite of one's internal experience. Results are reported for the 7-item version only in this study.

Valuing Questionnaire (VQ; Smout, Davies, Burns, & Christie, 2014). The VQ is a 10-item self-report measure designed to assess engagement of personal values over the previous week. Unlike other measures of valued living, the VQ does not include language for specific life domains; rather, it is designed to measure engagement with valued living in general. It has a confirmed two-factor structure, labeled as "Progress" and "Obstruction" in valued living. It has good convergent validity, and its scores are distinguishable between clinical and non-clinical populations (Smout et al., 2014).

5-trial adjusting delay discounting task (Koffarnus & Bickel, 2014). Delay discounting is an approach used to investigate an organism's preference between a smaller, immediate reward versus a larger, delayed reward (Madden & Bickel, 2010). The present study utilized the 5-item adjusting discounting task designed by Koffarnus and Bickel (2014). Participants made choices between hypothetical monetary amounts discounted by delay. Each response to the task caused the next choice to have different options, depending on whether an individual chose the immediate or delayed reward. After 5 items, this task generates a *k* value that acts as the discounting parameter for the individual participant. Koffarnus and Bickel (2014) have previously found *k* values generated by this task to correlate strongly with *k*s derived from typical discounting assessments.

Results

Missing Data

Some of the maximal completer sample (215) did not complete all of the fields on the Time Allocation Task. No obvious trends were detected between the 11 participants with missing data and the rest of the sample. Therefore, data analysis involved listwise deletion, and the final *n* for data analyses was 204. Table 2 compares the completer sample to the non-completers in a series of t-tests. The completer sample scored significantly higher on the BADS (M = 105.33, SD = 21.86) than the non-completers (M = 99.16, SD = 23.93), $t(387) = 2.51$, $p = .01$ two-tailed, Cohen's $d = .27$, 95% CI: -0.47 to -0.07. The completer sample also scored significantly higher on the SF-36 Physical Health subscale (M = 80.59, SD = 13.92) than the non-completers (M = 76.64, SD = 17.62), $t(387) = 2.46$, p = .01, two-tailed, Cohen's $d = .25$, 95% CI: -0.45 to -0.05.

Table 2

T-test Comparisons of Completers to Non-Completers on Study Variables.

Variables (M; SD)	Completers (n = 204)	Non-Completers (n = 185)	T-test	*P*	Cohen's *d*
PHQ-9	14.97 (5.48)	15.60 (5.80)	-1.01	.26	.11
BADS	105.33 (21.86)	99.16 (23.93)	2.51	.01	.27
SF-36 Physical	80.59 (13.92)	76.64 (17.62)	2.46	.01	.25
SF-36 Mental	65.16 (22.00)	65.20 (22.53)	-0.01	.98	.01
AAQ-2	20.27 (10.31)	20.00 (10.14)	0.26	.79	.02
VQ-Pro	21.02 (5.40)	20.94 (5.61)	0.14	.88	.01
VQ-Obs	12.85 (5.71)	13.32 (5.49)	-0.83	.40	.08
ln *k*	-5.48 (1.59)	-5.57 (2.01)	0.51	.60	.05

Due to an error, the final question of the SF-36 ("My health is excellent") was omitted from the Qualtrics survey for the first 62 participants. This question is part of the General Health subscale. In another study using the SF-36, researchers calculated a "person specific estimate," an average of the non-missing items, and substituted this value for the missing items as long as less than half of the items for a scale were missing (McHorney, Ware, Jr., Lu, & Sherbourne, 1994). Therefore, a person specific estimate was calculated for the 62 participants who were missing one item from their General Health subscale, and data were analyzed normally.

Preliminary Analyses

All data were screened for skewness and kurtosis. As expected, the sample was skewed on age with a coefficient of 2.9 (SE = .17) and predominantly female. The sample was also skewed on the SF-36 physical health composite score with a coefficient of -1.04 (SE = .17), indicating this sample's response fell disproportionately on the healthy side of this scale's distribution. The sample was also skewed on average time spent in managing life's negatives with a coefficient of 1.74 (SE = .17). Table 3 lists the descriptive statistics for the present sample. Table 4 displays a bivariate correlation matrix for all study variables.

Table 3

Descriptive Statistics

	Min.	Max.	Mean	Std. Deviation	Variance	Skewness[1]	Kurtosis[2]
Age	18	56	22.34	6.64	44.13	2.91	9.77
HrsPerWeek	0	60	17.10	15.37	236.36	0.55	-0.53
PHQ9_Sum	9	31	14.96	5.48	30.05	0.99	0.07
PHQ9_Sev	1	4	1.59	0.74	0.55	1.38	2.07
BADS_Act	0	42	23.79	8.48	72.03	-0.38	0.07
BADS_AR	0	36	12.98	10.10	102.13	0.48	-0.81
BADS_WSI	0	25	7.71	5.72	32.75	0.77	0.03
BADS_SI	0	28	5.64	6.56	43.12	1.26	1.02
BADS_Total	44	144	105.33	21.86	478.05	-0.61	-0.10
AAQ_EA	7	49	20.27	10.31	106.43	0.55	-0.67
AAQ_Eng	3	21	13.17	3.43	11.79	-0.04	0.02
SF36_PCS	36.88	100	80.59	13.92	193.96	-1.04	0.46
SF36_MCS	16.25	100	65.15	21.99	483.99	-0.51	-0.90
VQ_Pro	5	30	21.02	5.40	29.24	-0.49	-0.07
VQ_Ob	5	30	12.85	5.71	32.70	0.53	-0.32
ln_k	-9.12	1.94	-5.48	1.59	2.55	0.34	2.18
Avg_SRPlus	0	15.21	5.82	3.08	9.53	0.38	-0.11
Avg_SRMinus	0	14.29	2.57	2.74	7.54	1.74	3.34
Avg_Sleep	0	15.08	8.63	1.39	1.93	-0.65	9.45
Avg_Slop	0	14.02	6.90	3.54	12.56	-0.22	-0.58
Avg_Qual_P	1	10	6.69	1.93	3.75	-0.67	0.63
Avg_Qual_M	0	10	5.97	2.78	7.76	-0.24	-0.90
Avg_Qual_Sleep	1	10	6.62	1.59	2.53	-0.66	0.34

Note: n = 204; [1]Skewness SE = .17; [2]Kurtosis SE = .33

Table 4

Bivariate Correlation Matrix

	1	2	3	4	5	6	7
1 Age	-						
2 Hours Worked Per Week	.30**	-					
3 PHQ-9 Total	-.18**	.05	-				
4 BADS Act	.21**	.00	-.27**	-			
5 BADS AR	-.17*	-.03	.67**	-.19**	-		
6 BADS WSI	-.10	.11	.59**	-.27**	.66**	-	
7 BADS SI	-.14*	-.04	.53**	-.17*	.64**	.41**	-
8 BADS Total	.20**	-.01	-.70**	.49**	-.89**	-.75**	-.76**
9 Experiential Avoidance	-.17*	.01	.67**	-.25**	.74**	.53**	.63**
10 SF36-Physical Health	.05	.04	-.44**	.09	-.42**	-.32**	-.30**
11 SF36-Mental Health	.12	-.04	-.70**	.28**	-.70**	-.57**	-.57**
12 VQ-Progress	.18**	-.05	-.47**	.63**	-.38**	-.36**	-.36**
13 VQ-Obstruction	-.20**	-.03	.64**	-.34**	.69**	.54**	.59**
14 Natural Log *k*	-.01	.02	.15*	-.14*	.18**	.16*	.13
15 Average SR+	.12	.07	-.14*	.20**	-.11	-.07	-.09
16 Average SR-	.01	.12	.26**	.03	.14*	.19**	.14*
17 Average Sleep	-.21**	-.24**	.01	-.17*	.04	-.02	.03
18 Average Slop	-.02	-.04	-.08	-.14*	-.01	-.06	-.03
19 Average Qual. SR+	.15*	.05	-.28**	.34**	-.30**	-.25**	-.24**
20 Average Qual. SR-	.13	.06	-.33**	.44**	-.37**	-.30**	-.29**
21 Average Qual. Sleep	-.03	-.17**	-.36**	.25**	-.24**	-.27**	-.17*

Note. * $p < .05$; ** $p < .01$

Table 4 (continued)

	8	9	10	11	12	13	14
1 Age							
2 Hours Worked Per Week							
3 PHQ-9 Total							
4 BADS Act							
5 BADS AR							
6 BADS WSI							
7 BADS SI							
8 BADS Total	-						
9 Experiential Avoidance	-.75**	-					
10 SF36-Physical Health	.40**	-.41**	-				
11 SF36-Mental Health	.73**	-.75**	.53**	-			
12 VQ-Progress	.57**	-.49**	.20**	.50**	-		
13 VQ-Obstruction	-.74**	.75**	-.41**	-.74**	-.46**	-	
14 Natural Log *k*	-.21**	.17*	-.14*	-.16*	-.18**	.11	-
15 Average SR+	.14*	-.17*	.02	.11	.22**	-.19**	-.12
16 Average SR-	-.16*	.18*	-.16*	-.31**	-.16*	.27**	-.02
17 Average Sleep	-.00	.08	.09	-.01	-.09	.12	.06
18 Average Slop	.01	-.01	.11	.14*	-.02	-.07	.09
19 Average Qual. SR+	.36**	-.26**	.07	.31**	.46**	-.30**	-.09
20 Average Qual. SR-	.46**	-.35**	.11	.33**	.41**	-.35**	-.12
21 Average Qual. Sleep	.30**	-.22**	.20**	.30**	.32**	-.25**	-.16*

Note. * $p < .05$; ** $p < .01$

Table 4 (continued)

	15	16	17	18	19	20	21
1 Age							
2 Hours Worked Per Week							
3 PHQ-9 Total							
4 BADS Act							
5 BADS AR							
6 BADS WSI							
7 BADS SI							
8 BADS Total							
9 Experiential Avoidance							
10 SF36-Physical Health							
11 SF36-Mental Health							
12 VQ-Progress							
13 VQ-Obstruction							
14 Natural Log *k*							
15 Average SR+	-						
16 Average SR-	-.23**	-					
17 Average Sleep	-.12	-.20**	-				
18 Average Slop	-.66**	-.49**	-.02	-			
19 Average Qual. SR+	.41**	-.19**	-.12	-.17*	-		
20 Average Qual. SR-	.19**	.06	-.12	-.19**	.42**	-	
21 Average Qual. Sleep	.15*	-.19**	.00	-.02	.34**	.29**	-

Note. * $p < .05$; ** $p < .01$

Hypothesis Analyses

Pearson moment-to-moment correlations, one-way ANOVAs, and multiple linear regressions were used to test the study hypotheses. Correlations of Hypothesis 1 are shown in Table 5 below. Alpha was set at .05 for all statistical tests.

Table 5

Observed Zero Order Correlations of Hypothesis 1

	PHQ-9	BADS Scores				
		Act	AR	WSI	SI	Total
Average SR+	-.14*	.20**	-.11	-.07	-.09	.14*
Average SR-	.26**	.03	.14*	.19**	.14*	-.16*
Average Sleep	.01	-.17*	.04	-.02	.03	-.06
Average Quality of SR+	-.28**	.34**	-.30**	-.25**	-.24**	.36**
Average Quality of SR-	-.33**	.44**	-.37**	-.30**	-.29**	.46**
Average Quality of Sleep	-.36**	.25**	-.24**	-.27**	-.17*	.30**

Note. * $p < .05$; ** $p < .01$

Table 5 (continued)

	AAQ-2	SF36 Scales		VQ Scales		ln *k*
		PCS	MCS	Pro	Obs	
Average SR+	-.17*	.02	.11	.22**	-.19**	-.12
Average SR-	.18*	-.16*	-.31**	-.16*	.27**	-.02
Average Sleep	.08	.09	-.01	-.09	.12	.06
Average Quality of SR+	-.26**	.07	.31**	.46**	-.30**	-.09
Average Quality of SR-	-.35**	.11	.33**	.41**	-.35**	-.12
Average Quality of Sleep	-.22**	.20**	.30**	.32**	-.25**	-.16*

Note. * $p < .05$; ** $p < .01$

Pearson correlations. Significant correlations were found for many bivariate relationships predicted for positive and negative time allocation in Hypothesis 1. Unexpectedly, amount of sleep did not significantly relate to any study measures, aside from the BADS_Act subscale. In addition, correlations were found between quality ratings of each time domain and nearly all study measures. These correlations in particular were unexpected, though not unprecedented; other researchers have found stronger relationships with so-called pleasure scores than frequency scores in a sample of alcohol using college students (Correia, Carey, Simons, & Borsari, 2003).

One-way ANOVA. A one-way ANOVA was conducted to compare the effect of PHQ-9 cutoff category (mild, moderate, or severe; Arrol et al., 2010) on each of the sub components of the Time Allocation Task, as stated in Hypothesis 2. The effect of depression category on the average time spent managing life's negatives was significant, F (2, 201) = 5.75, p = .004, ω^2 = .044. The effect of depression category on the average time spent doing meaningful activities was not significant, F (2, 201) = 1.56, p = .212, ω^2 = .005. The effect was not significant on the average amount of sleep, F (2, 201) = 0.05, p = .95, ω^2 = .009, nor was it significant on the average unallocated time (or "slop"), F (2, 201) = 2.00 p = .138, ω^2 = .009. The effect of depression category on the average quality of meaningful activities was significant, F (2, 201) = 8.16, p < .001, ω^2 = .065. The effect of depression category on the average effectiveness of managing life's negatives was also significant, F (2, 201) = 12.11, p < .01, ω^2 = .098, as well as on the average quality of sleep, F (2, 201) = 11.62, p < .01, ω^2 = .094. Table 6 depicts the one-way ANOVA.

Table 6

One-way ANOVA of PHQ-9 symptom levels on Time Allocation

Measure	Mild (n = 120)	Moderate (n = 41)	Severe (n = 43)	F	P	ω^2
Average SR+	6.00	6.07	5.09	1.56	.212	.005
Average SR-	2.08	2.89	3.65	5.75	.004	.044
Average Sleep	8.61	8.63	8.69	0.05	.950	.009
Average Slop	7.29	6.10	6.56	2.00	.138	.009
Average Quality of SR+	7.05	6.69	5.70	8.16	<.001	.065
Average Quality of SR-	6.64	5.72	4.34	12.11	<.001	.098
Average Quality of Sleep	6.92	6.77	5.63	11.62	<.001	.094

Multiple regression. A series of multiple linear regression analyses were performed, in order to evaluate the predictive validity of the Time Allocation Task and its component questions, as stated in Hypothesis 3. Regressions were run to 1) estimate how well the Time Allocation Task predicts PHQ-9 scores, 2) estimate how well the Time Allocation Task predicts BADS scores, 3) estimate how age, established measures, and the Time Allocation Task, predict PHQ-9 scores when entered in respective sequential blocks, and 4) estimate how Time Allocation, demographics, and established measures, predict PHQ-9 scores in respective sequential blocks.

Regression 1. A multiple regression was run to examine how the different components of the Time Allocation Task (Average SR+, Average SR-, Average Sleep, Average Quality of SR+, Average Quality of SR-, and Average Quality of Sleep) predicted depression as measured by the PHQ-9. The overall regression was significant; these six predictors accounted for 22% (R^2= .223) of the variability in PHQ-9 scores, F (6, 197) = 10.735, p < .001. Inspection of beta weights showed that only Average SR- (β = .243, p < .001), Average Quality of SR- (β = -.265, p < .001) and Average Quality of Sleep (β = -.226, p = .001) were significant predictors in this

model. No other predictors in this model approached significance. Table 7 depicts the regression results.

Table 7

Multiple Regression Analysis of Time Allocation Prediction of PHQ-9 Scores

	B	SE B	B
Constant	21.621	3.082	
Average SR +	.029	.123	.016
Average SR -	.485	.136	.243**
Average Sleep	.120	.255	.030
Average Qual. SR +	-.126	.217	-.045
Average Qual. SR -	-.522	.139	.265**
Average Qual. Sleep	-.777	.234	.226**
R^2		.223	
F		10.735**	

Note: * p < .05, ** p < .01

Regression 2. Multiple regression also examined how the six questions of time allocation predicted depression as measured by the BADS. The overall regression was again significant; the total model predicted 26% (R^2= .265) of variability in BADS scores, F (6, 197) = 13.185, p < .001. Inspection of beta weights showed that only Average SR- (β = -.162, p = .015) and Average Quality of SR- (β = .382, p < .001) were significant predictors, with Average Quality of SR+ (β = .146, p = .053) and Average Quality of Sleep (β = .119, p = .076) approaching significance. Table 8 depicts the results of the regression.

Table 8

Multiple Regression Analysis of Time Allocation Prediction of BADS Scores

	B	SE B	B
Constant	76.471	11.960	
Average SR +	-.374	.479	-.053
Average SR -	-1.292	.526	-.162*
Average Sleep	-.601	.990	-.038
Average Qual. SR +	1.642	.843	.146
Average Qual. SR -	2.995	.541	.382**
Average Qual. Sleep	1.611	.908	.117
R^2		.265	
F		13.185**	

Note: * p < .05, ** p < .01

Regression 3. A hierarchical multiple regression was conducted to examine how well age (Step 1), established measures (Step 2), and Time Allocation Task questions (Step 3) predicted PHQ-9 scores. Predictors were entered as whole blocks in each step. Demographics included hours worked per week, degree of parental education, and age. Since hours worked per week did not reach significance, age was the only demographic variable tested due to being the only other continuous variable. The established measures block consisted of the BADS total, the SF-36 physical health scale, the SF-36 mental health scale, experiential avoidance as measured by the AAQ-2, the VQ Progress and Obstruction scales, and the natural log of *k*, the monetary discounting parameter. The time allocation block consisted of the six items as defined in Regression 1.

At step 1, age was entered into the regression; it accounted for an estimated 3% of variance (R^2= .030), F (1, 202) = 7.201, p = .008. At step 2, the established psychometric measures were entered. The model at step 2 accounted for 57% of variance (R^2= .577), F (8, 195) = 35.655, p < .001. In this step, age was dropped as a significant predictor (β = -.045, p = .341). The BADS total (β = -.274, p = .001) and SF-36 Mental Health (β = -.235, p = .007) and

the AAQ-2 were significant (β = .170, p = .041). At step 3, the Time Allocation Task was entered. The model at step 3 accounted for a similar amount of variance as step 2, (R^2= .588), and this change in variance accounted for was not significant, F-change (14, 189) = 1.836, p = .094. Of the time allocation variables, only average sleep quality was a significant predictor within the overall model (β = -.139, p = .007). Table 9 depicts the hierarchical multiple regression.

Table 9

Hierarchical Multiple Regression of Demographics, Established Measures, and Time Allocation on PHQ-9 Scores

	Step 1			Step 2			Step 3		
	B	SE B	β	B	SE B	β	B	SE B	β
Constant	18.326	1.325		29.740	3.558		31.002	3.931	
Age	-.153	.057	-.186**	-.037	.039	-.045	-.058	.040	-.070
BADS Total				-.070	.021	-.277**	-.069	.021	-.274**
AAQ-2				.076	.044	.143	.090	.044	.170*
SF36 Physical				-.039	.021	-.099	-.032	.021	-.082
SF36 Mental				-.067	.021	-.271**	-.059	.021	-.235**
VQ Progress				-.059	.058	-.058	-.038	.061	-.037
VQ Obstruction				.047	.077	.049	.026	.078	.027
ln *k*				.001	.162	.000	-.025	.162	-.007
Average SR +							-.021	.092	-.012
Average SR -							.141	.106	.071
Average Sleep							-.061	.193	-.016
Average Qual. +							.149	.166	.053
Average Qual. -							-.027	.110	-.014
Average Qual. Sleep							-.480	.177	-.139**
R^2		.030			.577			.588	
F for R^2 change		7.20**			38.38**			1.836	

Note: * $p < .05$, ** $p < .01$

Regression 4. Hierarchical regression was employed in a similar fashion to Regression 3. For this regression, the order of entered blocks was changed. Time allocation (Step 1), age (Step 2), and established measures (Step 3) were entered into a multiple regression predicting PHQ-9 scores.

At step 1, time allocation was entered; it accounted for approximately 22% of variance (R^2= .223), F (6, 197) = 10.735, p < .001. The beta weights and significance levels were identical to Regression 1, given that it was the exact same procedure. At step 2, age was added; the model at step 2 accounted for 24% of variance (R^2= .245), F-change (7, 196) = 6.64, p < .001. The beta weights from step 1 remained largely unchanged. At step 3, the established measures were added; this model accounted for 58% of variance (R^2= .588), F-change (14, 189) = 24.293, p < .001. At this step, Average SR- (β = .071, p = .185) and Average Quality of SR- (β = -.014, p = .808) dropped out as significant predictors. BADS scores (β = -.274, p = .001), experiential avoidance (β = .170, p = .041), and SF-36 Mental Health (β = -.235, p = .007) were significant among the predictors added in step 3, with SF-36 Physical Health (β = -.082, p = .14) approaching significance. Table 10 depicts the multiple regression.

Table 10

Hierarchical Multiple Regression of Time Allocation, Demographics, and Established Measures on PHQ-9 Scores

	Step 1			Step 2			Step 3		
	B	SE B	β	B	SE B	β	B	SE B	β
Constant	21.621	3.082		25.530	3.396		31.002	3.931	
Average	.029	.123	.016	.044	.122	.025	-.021	.092	-.012
SR + Average	.485	.136	.243**	.480	.134	.241**	.141	.106	.071
SR - Average	.120	.255	.030	-.003	.256	-.001	-.061	.193	-.016
Sleep Average	-.126	.217	-.045	-.075	.215	-.026	.149	.166	.053
Qual. + Average	-.522	.139	-.265**	-.49	.138	-.251**	-.027	.110	-.014
Qual. - Average	-.777	.234	-.226**	4 -.839	.232	-.244**	-.480	.177	-.139**
Qual. Sleep									
Age				-.135	.052	-.164	-.058	.040	-.070
BADS Total							-.069	.021	-.274**
AAQ-2							.090	.044	.170*
SF36 Physical							-.032	.021	-.082
SF36 Mental							-.059	.021	-.235**
VQ Progress							-.038	.061	-.037
VQ Obstruction							.026	.078	.027
ln k							-.026	.162	-.007
R^2		.223			.245			.588	
F for R^2change		10.73**			6.64**			24.29**	

Note: * $p < .05$, ** $p < .01$

Matching analysis. Preliminary examination of the ratios of Average SR+/Average SR- and Quality of SR+/Quality of SR- for each participant indicated very high variability. To test whether the data from the Time Allocation Task fit the assumptions of matching, in which time allocated is analogous to response allocation and quality ratings are proxies for reinforcer rates, data for three participants were plotted according to the procedure outlined for conducting matching analyses in Reed (2009). Results indicated that the present data do not fit the assumptions of generalized matching. This is most likely due to the quality ratings serving as poor proxies for rate of reinforcement.

Discussion

The present study sought to evaluate whether a novel measure of time allocation could capture the time allocation of participants in three different categories and to examine the possible relationships between this measure and established measures of psychological health and behavioral processes. Hypotheses related to convergent and discriminant validity were largely supported. Average time spent in meaningful activities (Average SR+) correlated positively with the activation factor of the BADS, the BADS composite score, the Progress subscale of the VQ, and each of the quality categories (SR+, SR-, and sleep). Average SR+ correlated negatively with depression (PHQ-9), hours worked per week, experiential avoidance, the Obstruction subscale of the VQ, and average time spent managing life's negatives (Average SR-). Average SR-, meanwhile, was positively correlated with depression, the Work-School Impairment, Avoidance/Rumination, and Social Impairment factors of the BADS, experiential avoidance, and the Obstruction subscale of the VQ. Average SR- was negatively correlated with the BADS composite score, the SF-36 (both mental and physical health factors), the Progress subscale of the VQ, Average SR+, Average Sleep, and quality ratings of both SR+ and sleep.

One correlation that was expected but did not reach significance included a negative relationship between Average SR- and the Activation subscale. Overall, however, Average SR+ and Average SR- were correlated with other measures as theoretically expected. Average SR+ was significantly related to several measures of psychological health and distress, as was Average SR-.

The quality ratings of these categories demonstrated strong, significant relationships that were not expected. In a one-way ANOVA, most of the assessment questions on the Time Allocation Task were differentiated on the basis of PHQ-9 score hierarchies, with a marginal effect size for Average SR- and medium effect sizes for the quality ratings. When examining Average SR+ and the quality of SR+ time, participants were differentiated in depression severity by SR+ quality, and while not statistically significant, there was a trend for less depressed participants to allocate more time towards meaningful activities. Given the lack of a correlation between Average SR- and its effectiveness ratings and the larger effect size for the effectiveness rating, it may be that while time spent managing life's negatives is an indicator of depression, it seems to be a weak one, and that low effectiveness evaluations of that time is more relevant to predicting depression. This suggests that avoidance patterns themselves may not be problematic, but that avoidance becomes problematic when it is ineffective.

A multiple linear regression analysis showed that the Time Allocation Task accounted for up to 22% of unique variance in predicting PHQ-9 scores, and up to 26% in predicting BADS scores. However, hierarchical multiple regression showed that the Time Allocation Task largely did not account for PHQ-9 score variance when other measures were controlled for. Thus, while some predictive validity was demonstrated, there is not a strong case for the incremental validity of the Time Allocation Task at this time. In addition, some of the multiple regressions did not

fully meet all of the required assumptions, specifically regarding collinearity. While VIF and tolerance statistics were all within normal limits, condition indices exceeded 30 in some models for Regressions 3 and 4. Thus, those results should be interpreted with caution. These results may have been impacted by the severity screener of the PHQ-9 being skewed and by the overall lower mean of depression scores (~15) in the present sample. A larger sample size, that included more individuals with clinically significant levels of distress, may yield different results.

Several multiple regression analyses provided preliminary support that sleep quality, average time spent managing life's negatives, and the effectiveness ratings of managing those negatives are relevant predictors of depression on the PHQ-9. Despite significant correlations in the expected directions, the other indices of the Time Allocation Task were not significant predictors when other factors were controlled. These relationships, in concert with the very high correlation found between the AAQ-2 and PHQ-9 in this study, may support an experiential avoidance paradigm of psychopathology (Hayes et al., 1996). A recent study of behavioral activation for older adults (n = 20) with depression and signs of complicated bereavement showed that neither total activities nor the kind of activity were associated with improvement (Hershenberg, Paulson, Gros, & Acierno, 2015). Avoidance, and the evaluation of the success of that avoidance, may be the behavioral patterns that were most relevant. Alternatively, the instructions for participants in filling out the Time Allocation Task may have been experienced as obtuse, and thus the face validity of the measure may have been affected. The accuracy ratings may be serving as a proxy for how obtuse the instructions were (i.e., low accuracy = "I'm not sure what you are asking"). Across participants, time allocation estimates were obtained for 1,428 days. Participants rated the accuracy of their estimates as highly accurate (40%), moderately accurate (44%), or roughly accurate (17%). While this suggests that there is room for

improvement in how time allocation data are collected, the relatively low percentage of "roughly accurate" ratings suggests that most of the participants were able to comprehend the exercise's instructions.

A positive and significant (yet small, at .23) relationship was found between average time allocated toward meaningful activities and the VQ Progress subscale. A stronger relationship was expected, and this project's connecting meaningful activities as sometimes involving "hard work" distinguishes the framing of the time allocation assessment with the VQ's only emphasizing that the meaningful activities are connected with a sense of purpose.

Of note in this study, is the fact that the subjective 0–10 quality (SR+) and effectiveness (SR-) ratings were all significant and strongly related to many study variables. While the Time Allocation Task was designed and intended to capture patterns of responding over time, it may have more effectively captured perceived reinforcer strength instead. These results seem parallel to the findings by Hayes et al. (2010). Measures aimed to approximate responding (time allocation toward meaningful activities is similar to valued action) had a less robust relationship than subjective judgments of quality of time spent. This may be similar to changes in acceptance, where the self-report of being able to act consistent with values in the presence of adversity was more predictive than actual changes in valued action.

Strengths & Limitations

The present study has several important strengths. The design incorporated different measures with varying (yet related) theoretical models underlying them, including both a DSM taxonomic and behavioral process measure of depression (PHQ-9 and BADS, respectively) as the dependent variables. In addition to examining the validity of the Time Allocation Task in

predicting depression on these different measures, the present study's multiple measures served not only as a basis for establishing convergent and discriminant validity, but as a comparison of the incremental predictive validity of the novel measure. Experiential avoidance (AAQ-2), progress and obstruction of valued living (VQ), general medical assessment of physical and mental health (SF-36), and rates of impulsivity on a monetary discounting task (ln *k*) provided theoretically and empirically relevant constructs that served as a basis of comparison for the Time Allocation Task.

There are a number of important limitations to the present study. First, this study only utilized self-report measures, and thus mono-method bias may account for a significant amount of the results. Second, this study only recruited undergraduate psychology students from Eastern Michigan University, and thus it is not known whether the results could be generalizable to other populations of interest. In particular, the age and gender of participants were heavily skewed towards young and female. Third, this study had an attrition rate of 48% (attrition defined as individuals who did not complete all measures) with that proportion failing to return the time allocation worksheet. Those who completed the Time Allocation Task scored significantly higher on the BADS and SF-36 Physical than those who failed to complete it, indicating that the completers were more behaviorally activated, less behaviorally depressed, and physically healthier. It is possible that these differences contributed to participant attrition. It is also difficult to state how well the primary assessment questions on the Time Allocation Task (meaningful activities, managing life's negatives) accurately reflect time allocated toward positive and negative reinforcement. It is possible that participants may not have interpreted the questions consistent with these relations, and this is unknowable at present due to lack of a means for comparing the estimates to an actual criterion. Scholars in contemporary clinical behavioral

science have disagreed regarding the role, applicability and accuracy of "mid-level terms" in disseminating functional analytic thinking in clinical psychology (Kanter, Holman, & Wilson, 2014; Darrow & Follette, 2014). Further conceptual and empirical work is needed in order to determine what future iterations of the Time Allocation Task could resemble, and what conceptual level is appropriate for the language of the measure. The optimal use of the TAT may be asking individuals to employ it as a weekly tracking sheet, similar to other common measures of behaviors used to facilitate the process of therapy, such as behavior tracking sheets found in behavioral activation (Martell et al., 2010), Barlow et al.'s unified protocol for treatment of emotional disorders (2010), or emotion diaries and diary cards used in Dialectical Behavior Therapy (Linehan, 1993). The utility of this measure for clients and therapists would need to be explored to determine whether it has practical utility.

While there is basic research precedent for equating time allocation with response allocation, there is no precedent for equating quality/effectiveness ratings with the rate of reinforcement in human participants. Further, there is no known method for obtaining valid self-reports of rate of reinforcement data on categories as broad as SR+ and SR- retrospectively at the daily level. Future research could address this issue by comparing self-reports of these categories to data obtained in analogue research using behavioral performance tasks.

Future Directions

The data for the present study contains interesting directions for follow-up analyses. As previously stated in the literature review, many versions of the matching law have emerged in the empirical literature (McDowell, 2012). Since Herrnstein's (1970) original equation, many researchers have conceptualized the matching law from different perspectives. A major shift in matching law and matching theory occurred when researchers found that a power version of the

matching law better described matching behavior than the original equation (McDowell, 2012). The power version of the matching law is $\frac{B1}{B2} = b(\frac{r1}{r2})^a$, where *b* represents bias, or the tendency for an organism to find one schedule preferable to another for reasons aside from rate of reinforcement, and *a* represents sensitivity, an exponent that accounts for how the organism differentially values the reinforcement available. Both bias and sensitivity are free parameters; there is not an empirical method to derive them, rather they are varied in order to best fit the data. This version may account for results such as those seen by Baum (1975). Given that the data from the Time Allocation Task do not appear at present to fit the conceptual assumptions of the basic matching law, future analyses could consider the power version instead. For example, it may be that bias and sensitivity parameters, fitted to individual participant data, will account for the variability in responding. In addition, future analyses should consider the cross product of Time Allocated x Quality Rating. It may be that a Lewinsohnian (1973) interpretation of the data will be more useful in conceptualizing this assessment data. Lastly, the Flesch-Kincaid Grade Level for the Time Allocation Task instructions was 10.6. Future iterations of this assessment could consider consolidating or simplifying some of the text in the instructions in order to make them easier to read and understand.

Conclusion

In conclusion, despite the present limitations, the present study makes a contribution to the assessment and behavioral process literature. The Time Allocation Task may represent a useful clinical assessment tool; the present data provide some supporting evidence of convergent and discriminant validity in an undergraduate sample. The Time Allocation Task represents a novel extension of a basic behavioral principle towards clinical assessment; its theoretical underpinnings, brief form, and supporting data suggest that it may be an effective tool in the

conceptualization of psychological health from a clinical behavior analytic perspective. More research is needed in order to determine whether the Time Allocation Task has convergent and discriminant validity with other assessment measures. Research is also needed in order to determine the optimal presentation and wording of the assessment questions themselves. Finally, the clinical utility of the Time Allocation Task has yet to be determined. Further development of the measure will require addressing several different concerns, at varying levels of analysis, in line with the guidelines suggested by recent authors in order to strengthen the link between basic and applied psychological science (Hayes et al., 2013; Follette & Beitz, 2003).

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Appendix: EMU IRB Approval Letter

RESEARCH @ EMU

UHSRC Determination: **EXEMPT**

DATE: **March 25, 2015**

TO: **Cory Stanton, B.S.**
Department of Psychology
Eastern Michigan University

Re: **UHSRC: #677340-1**
Category: Exempt category 2
Approval Date: March 25, 2015

Title: **Where Does The Time Go? An Investigation of Self-Reported Time Allocation.**

Your research project, entitled **Where Does The Time Go? An Investigation of Self-Reported Time Allocation.**, has been determined **Exempt** in accordance with federal regulation 45 CFR 46.102. UHSRC policy states that you, as the Principal Investigator, are responsible for protecting the rights and welfare of your research subjects and conducting your research as described in your protocol.

Renewals: Exempt protocols do not need to be renewed. When the project is completed, please submit the **Human Subjects Study Completion Form** (access through IRBNet on the UHSRC website).

Modifications: You may make minor changes (e.g., study staff changes, sample size changes, contact information changes, etc.) without submitting for review. However, if you plan to make changes that alter study design or any study instruments, you must submit a **Human Subjects Approval Request Form** and obtain approval prior to implementation. The form is available through IRBNet on the UHSRC website.

Problems: All major deviations from the reviewed protocol, unanticipated problems, adverse events, subject complaints, or other problems that may increase the risk to human subjects **or** change the category of review must be reported to the UHSRC via an **Event Report** form, available through IRBNet on the UHSRC website

Follow-up: If your Exempt project is not completed and closed after **three years**, the UHSRC office will contact you regarding the status of the project.

Please use the UHSRC number listed above on any forms submitted that relate to this project, or on any correspondence with the UHSRC office.

Good luck in your research. If we can be of further assistance, please contact us at 734-487-3090 or via e-mail at human.subjects@emich.edu. Thank you for your cooperation.

Sincerely,

Alissa Huth-Bocks, Ph.D.
Chair
CAS Human Subjects Review Committee